The Past, Present and Future of the Regional Environmental Monitoring and Assessment Program

Office of Research and Development

EPA

EMAP's GOAL

- **Build the scientific basis, and the local, state, and tribal capacity, to monitor for status and trends in the condition of the Nation's aquatic ecosystems**

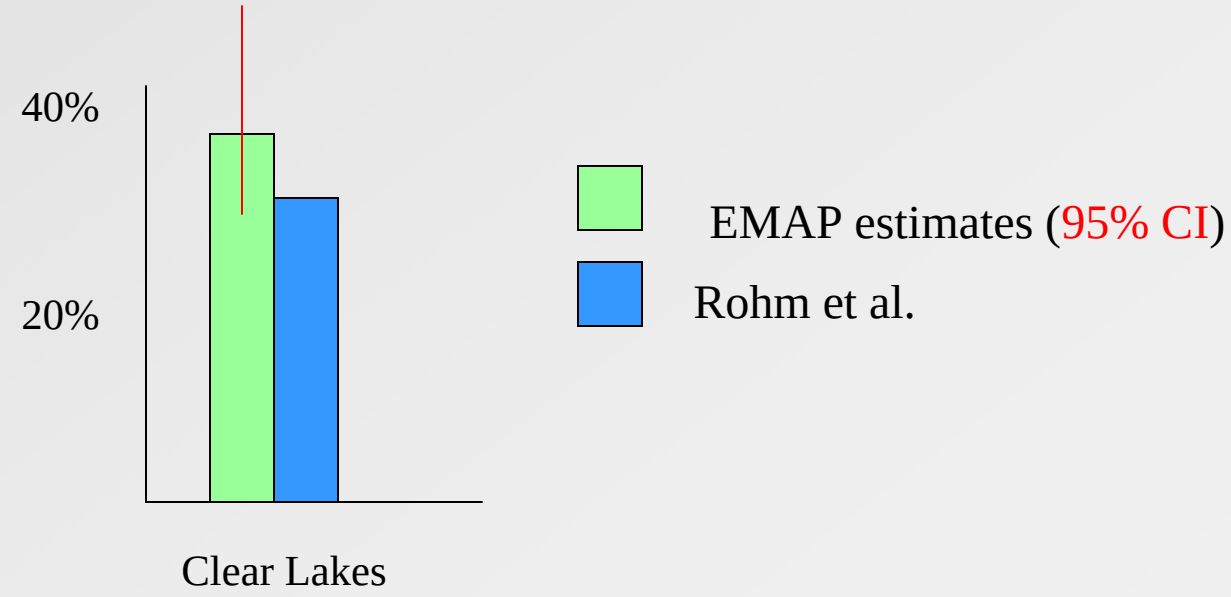
  - Cost-effective
  - Scientifically-defensible and representative
  - Quantifiable trends
  - Supports performance-based management (GPRA)

Conventional Monitoring

- > $650M/y spent on environmental monitoring by Federal Government
- Most is targeted to individual chemicals and to physical conditions at specific sites
- Point source problems have been greatly reduced

Cost Effectiveness of EMAP Approach

- Alabama monitoring costs 25% less, with more and better information
- Eutrophication of NE US lakes
  - –2756 non-random lakes censused (Rohm et al. 1995)
  - – EMAP reached same conclusion with only 344 lakes



Sound Scientific Basis for EMAP Approach

- **Publications**
  - >600 peer reviewed EMAP publications
- **Recent peer review by Ecological Society of America and American Statistical Association**
  - "...panel strongly supports the use of probability-based sample designs…GIS-based approaches provide important pattern and connectivity information…REMAP demonstration programs have put EMAP at the forefront of having solid data from both probability sampling and a GIS-based design…"(ESA and ASA 1998)

Environmental Decisions Using EMAP Science

- Region 3 - Mountain-top removal mining impacts
- Maryland - State of the Streams Report
- Oregon - Revised coho salmon assessment program
- Maine - Fish consumption advisory for Mercury

Unanswered Monitoring Questions

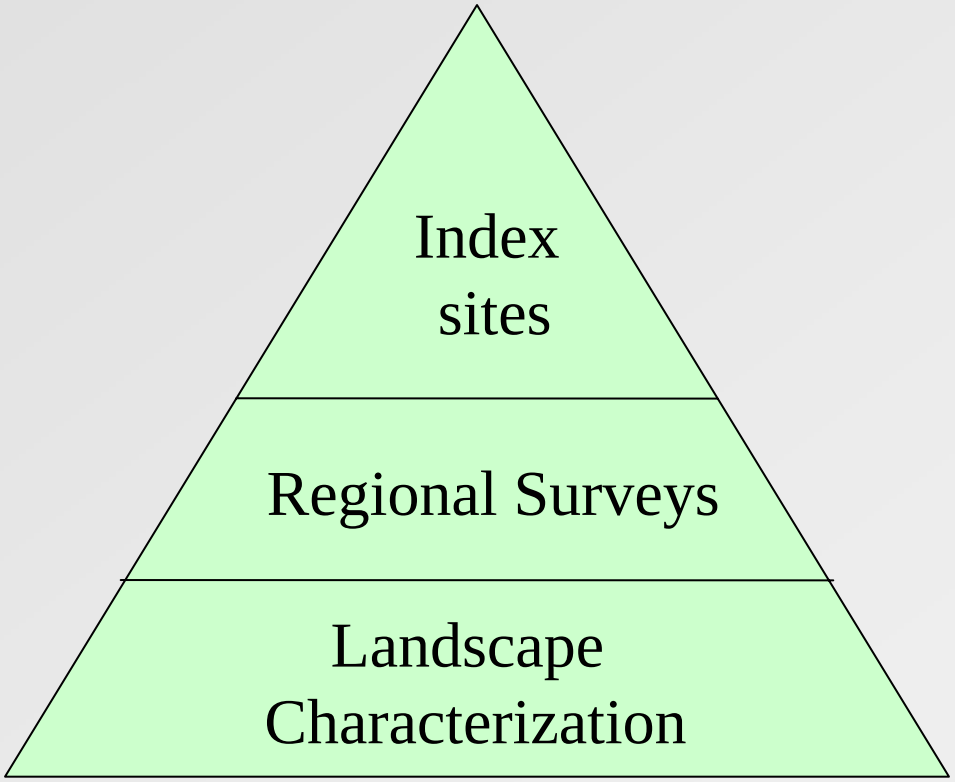
- How much of our state/national aquatic ecosystems are healthy?
- Are we targeting the right problems to make a difference?
- How do we measure trends in the condition of aquatic ecosystems?
- How do we determine this in a cost-effective, scientifically-defensible, and credible way?
- How do we aggregate this information from the local to the state to the national levels?

Why an EMAP Approach?

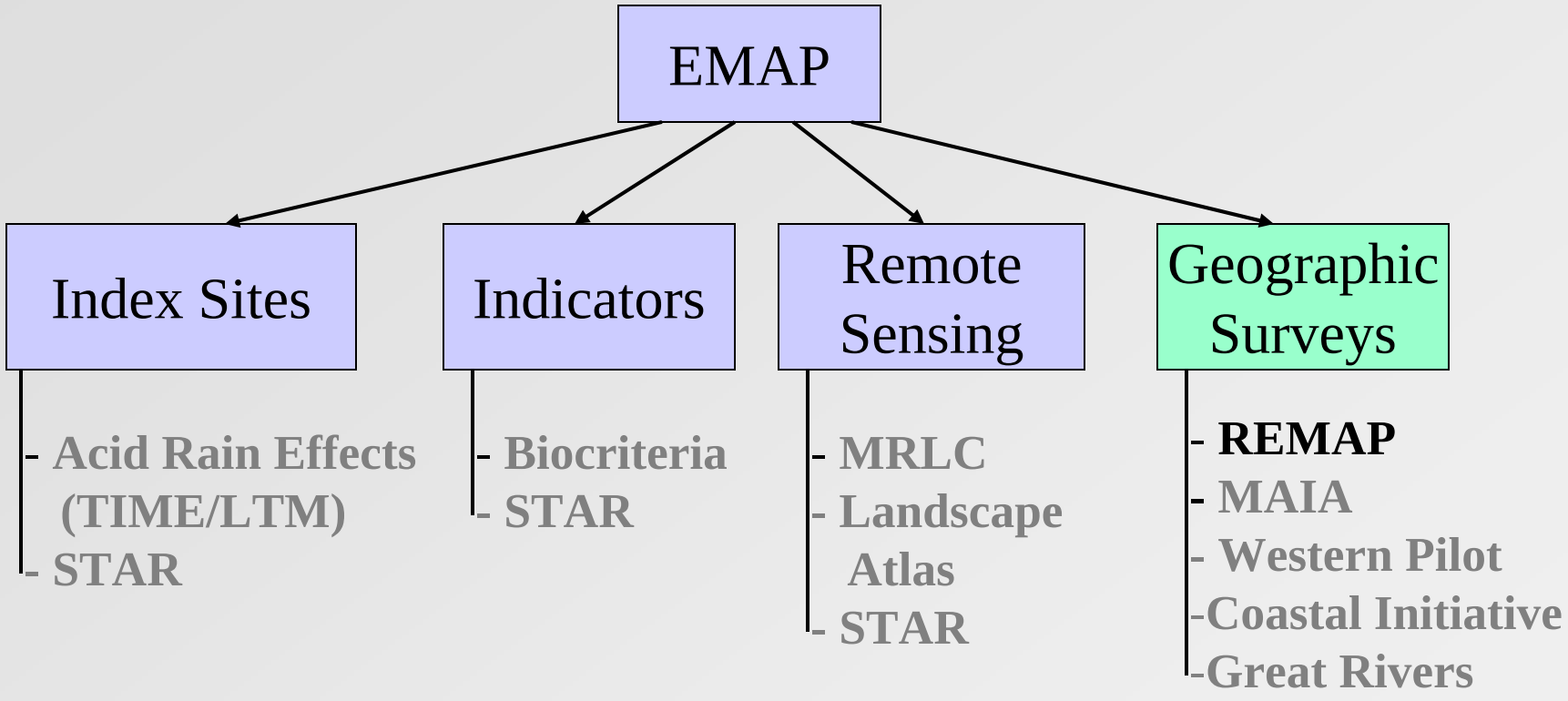
- **<u>Only</u> statistically-valid approach to determining state and national aquatic ecosystem condition**
  - uses biological indicators (e.g., fish and benthic community structure) as integrators of aquatic ecosystem condition
  - establishes measurable baselines for health of aquatic ecosystems and assesses trends in condition
  - reduces costs and identifies most important areas and stressors
  - provides monitoring designs for consistent aggregation of data from local to national levels
- **Already being used by states for improved assessments and better decision-making**

EMAP Design Components

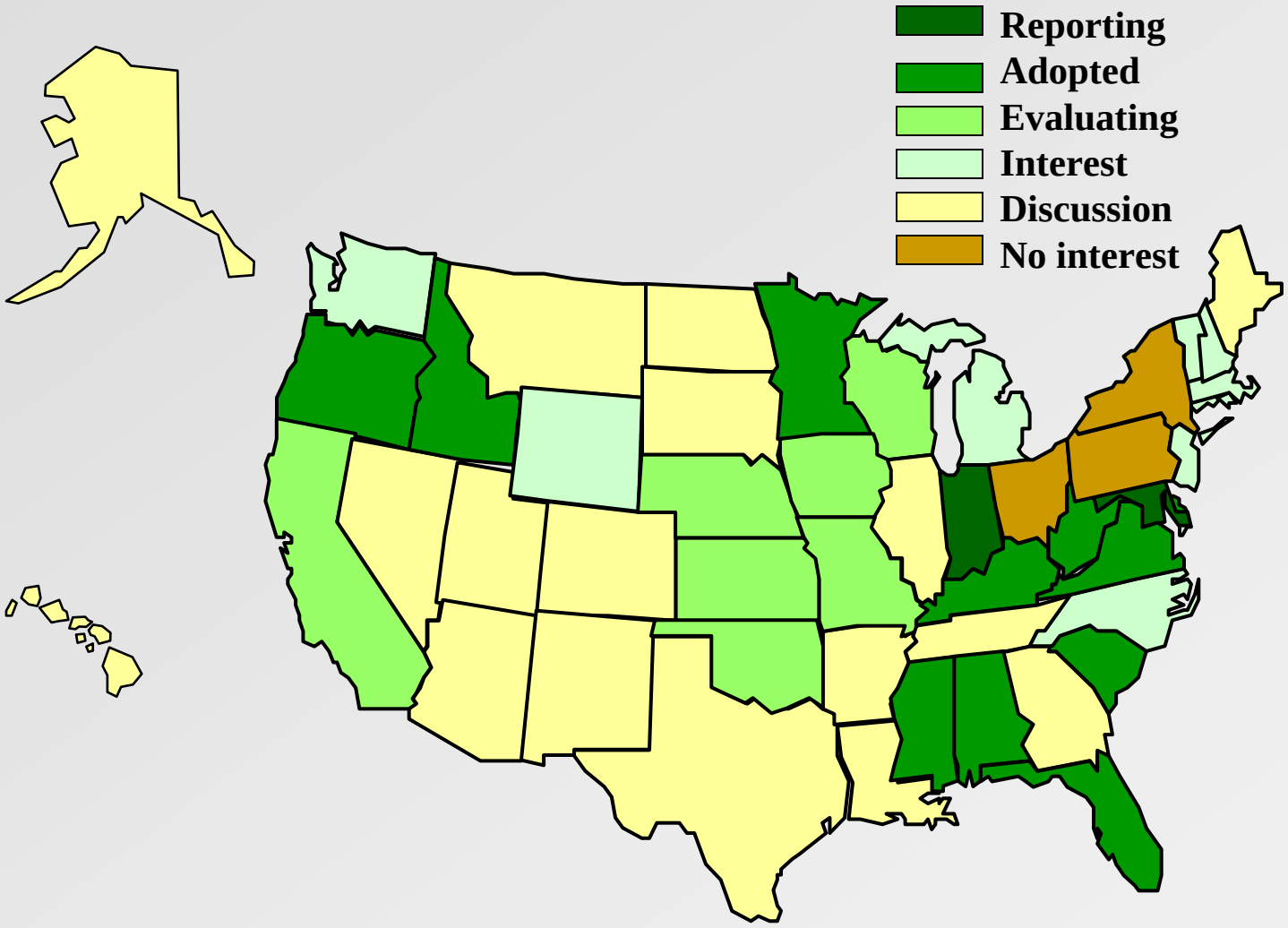
- **Multi-Tier Monitoring Designs -** scale defined design that allows aggregation and interpretation of monitored data



EMAP Research

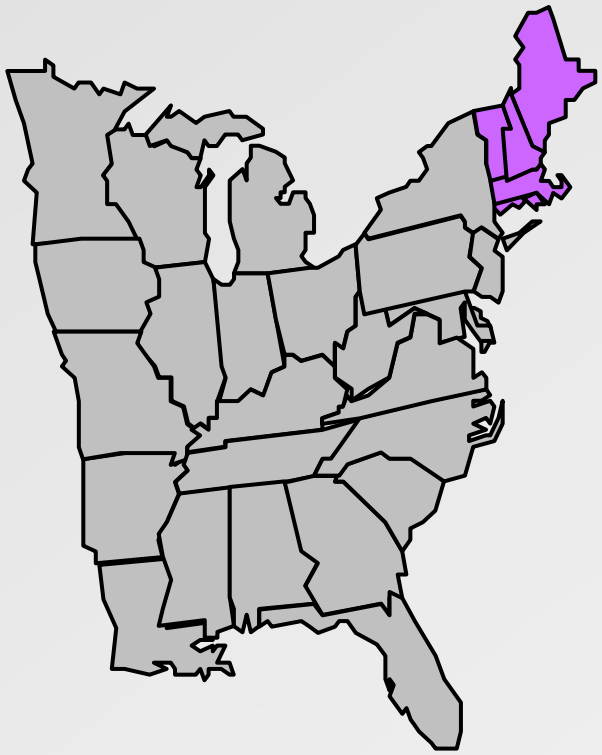


State Use of Probability Survey Designs



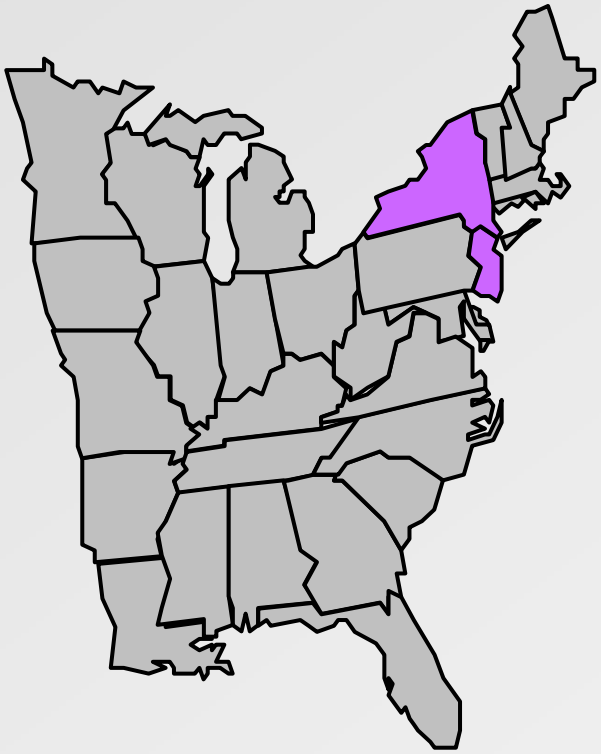
REMAP History-- Region 1

- **1993-94** — **Fish tissue contamination I Maine lakes**
- **1997-99** — **Assessment of Hg in waters, sediments, and biota of Vermont and New Hampshire lakes**
- **1997-98** — **Study of atmospheric Hg deposition in New England**
- **2001-02** — **Assessment of New England wadeable streams**
- **2003-04** — **Assessment of New England lakes and ponds**



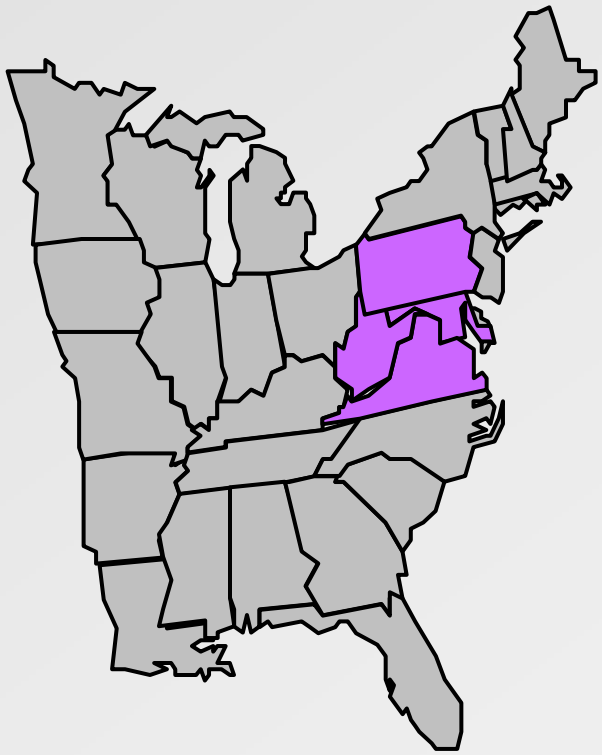
REMAP History-- Region 2

- **1993-94** — **Sediment quality of the NY/NJ harbor system**
- **1998-99** — **Trend assessment of the NY/NJ harbor system**
- **1999-2000** — **Cohansey-Maurice-Salem Rivers watershed assessment**
- **2001-02** — **Barnegat Bay estuary assessment**
- **2003-04** — **Trend assessment of the NY/NJ harbor system**



REMAP History--Region 3

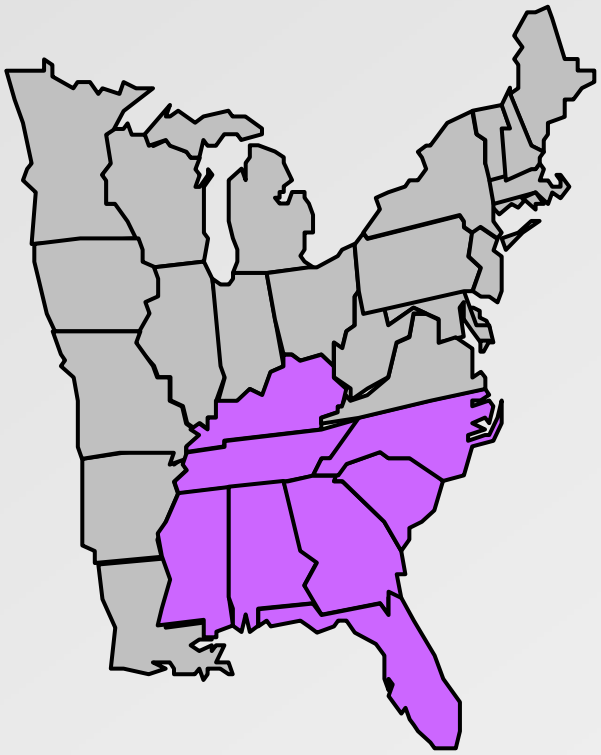
- **1993-95** — **Mid-Atlantic highland streams assessment**
- **1996-97** — **Development of a probability-based assessment of Maryland streams**
- **1998-99** — **Amphibian monitoring across the Mid-Atlantic states**
- **2000-01** — **Watershed-based monitoring of West Virginia streams**



- **2002-03** — **Probabilistic assessment of hydrophobic dissolved trace contaminants in non-tidal streams and rivers of Virginia**
- **2003-04** — **Validation and sensitivity analysis for rapid wetland assessments**

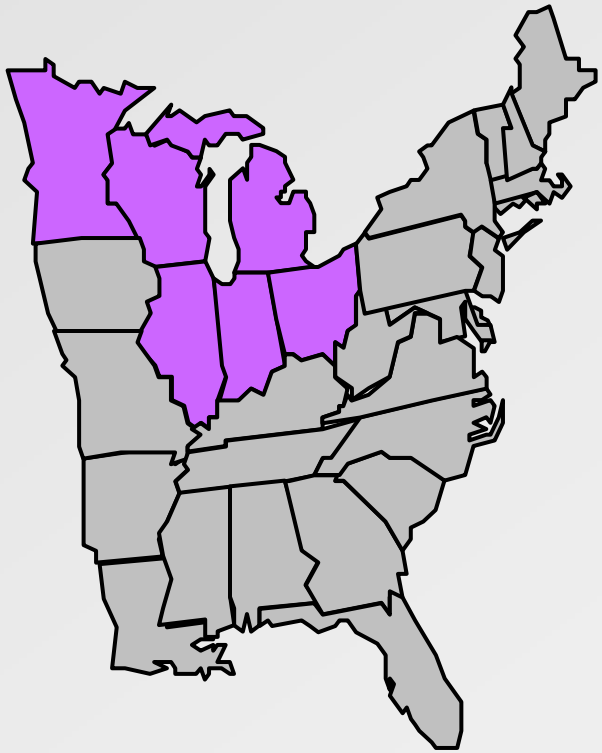
REMAP History—Region 4

- **1992-94** — **Hg contamination of South Florida ecosystems**
- **1994-95** — **Savannah River basins streams assessment**
- **1996-98** — **South Florida ecosystem restoration monitoring**
- **1998-2003** — **Hg contamination of South Florida ecosystems—trend assessment**
- **1999-2003** — **Southeastern wadeable streams assessment**



REMAP History-- Region 5

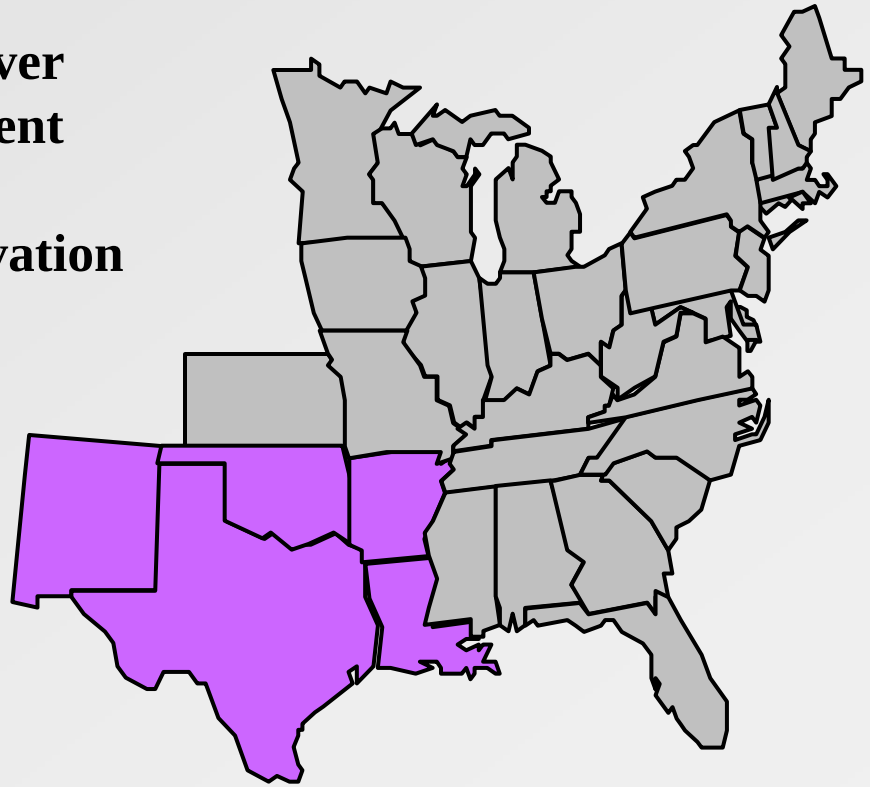
- **1995-96** — **St. Louis River environmental influences on benthic communities**
- **1995-96** — **Assessment of streams of the Eastern Cornbelt Plains ecoregion**
- **1998-99** — **Assessment of streams of the Northern Lakes and Forest ecoregion**



- **2000-01** — **Assessment of Great Lakes coastal wetlands**
- **2002-03** — **Wisconsin wadeable streams assessment**
- **2003-04** — **Biological assessment of large rivers of the Upper Mississippi and Ohio Rivers Basins**

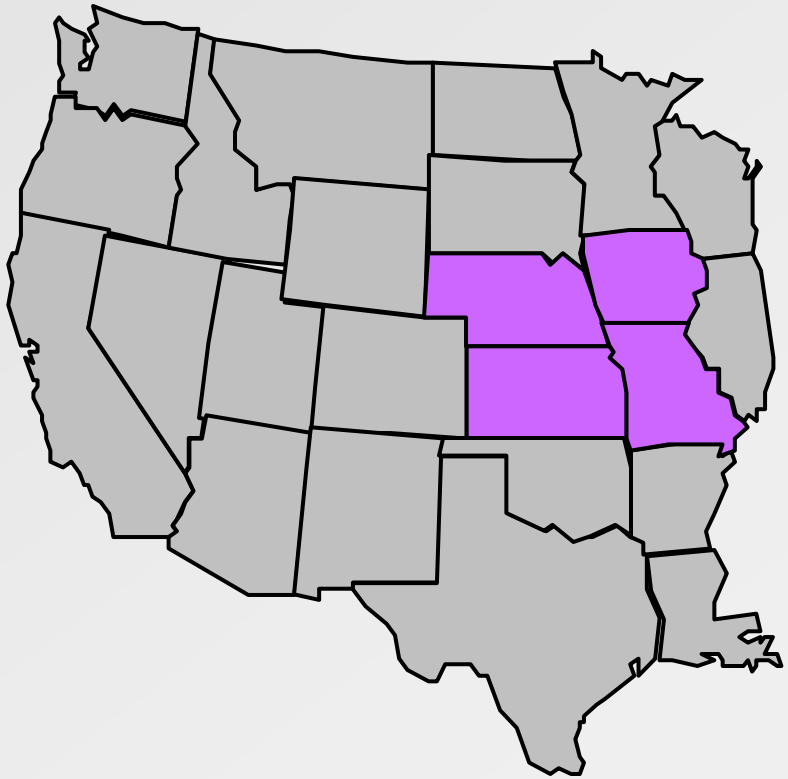
REMAP History-- Region 6

- **1993-94** Galveston Bay/Corpus Christi toxic substances assessment
- **1996-97** Habitat degradation in East Texas wadeable streams
- **1998-99** Lower Chama/Gila River Basins stream assessment
- **2001-02** Texas seagrass conservation monitoring
- **2002-03** Assessment of the biological condition of Lousiana streams and rivers



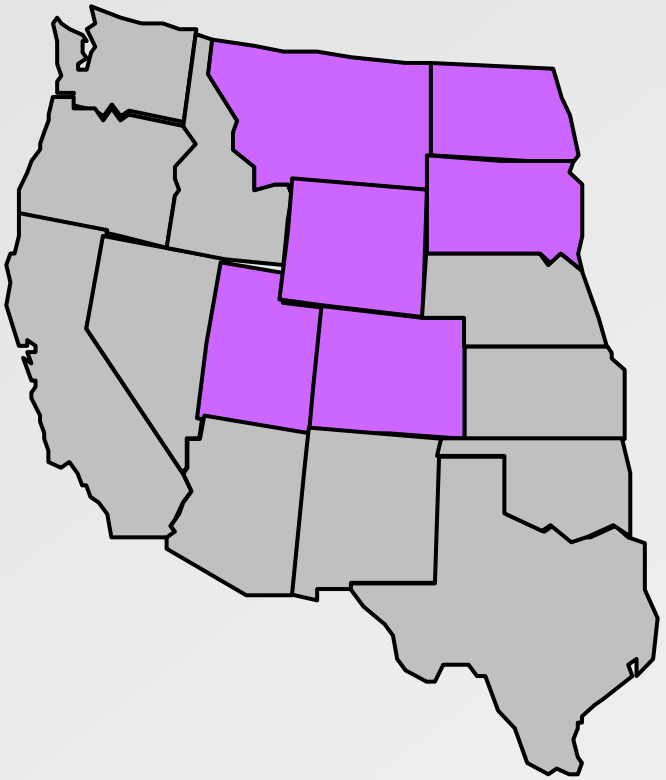
REMAP History-- Region 7

- **1994-95** — Assessments of Kansas, Missouri & Nebraska streams
- **1998-99** — Landscape analysis of Kansas streams and rivers
- **1999-2000** — Continuation of Kansas and Nebraska stream surveys
- **2001-02** — Assessment of Iowa streams and rivers
- **2002-03** — Assessment of Iowa wetlands
- **2003-04** — Ecological classification of Nebraska streams and rivers



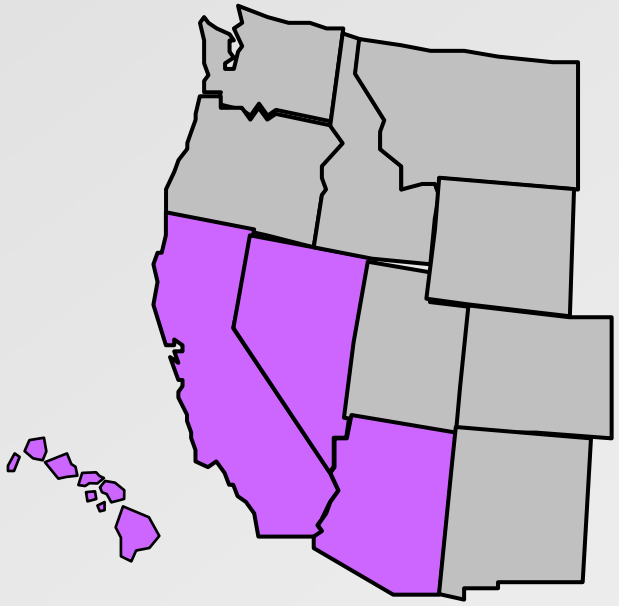
REMAP History-- Region 8

- **1993-94** — **Assessment of mining impacts on streams in the Southern Rockies ecoregion**
- **1996-97** — **Utah rangeland condition assessment**
- **1998-99** — **Montana prairie streams & North Dakota riverine wetlands assessments**
- **2000-04** — **EMAP Western streams**

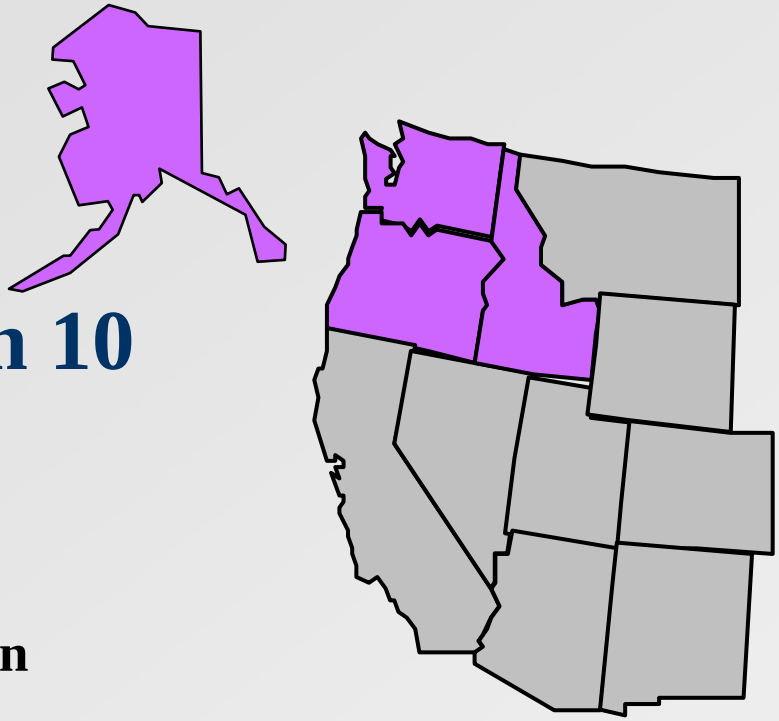


REMAP History-- Region 9

- **1994-95** — **California Central Valley stream assessment**
- **1997-2000** — **Assessment of the Humboldt, Walker, Muddy and Virgin Rivers basins in Nevada**
- **2000-04** — **EMAP western streams**



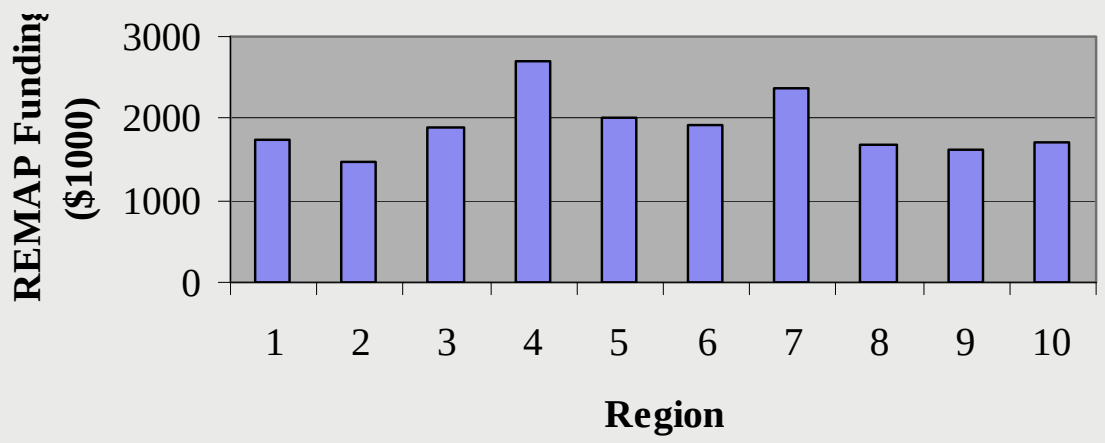
REMAP History-- Region 10



- **1995-96** — **Assessment of Coast Range streams in Oregon and Washington**
- **1997-98** — **Assessment of the Upper Deschutes River basin**
- **1999-2000** — **Assessment of streams of the Western Cascade Mountains of Oregon and Washington**
- **2000-04** — **EMAP western streams**

Annual REMAP and Partner Project Expenditures

Year	REMAP Funds ($M)	Other Funds ($M)
1993-94	$3.6	$5.0
1995-96	$2.7	$3.5
1997-98	$3.0	$3.4
1999-2000	$2.2	$3.7
2001-02	$3.4	$4.4
2003-04	$4.2	$7.3



Total REMAP=$19.1M
Total Projects=$27.2M

Future Directions

•**305b/303d—**EMAP/REMAP currently does a good job supporting 305b reporting, but needs to adjust designs to support 303d listing, TMDL and restoration.

•**Great Rivers—**EMAP/REMAP has not addressed the large, floodplain rivers. New efforts to support 305b assessments of these systems.

- **Designs**
- **Methods**
- **"Reference" condition**

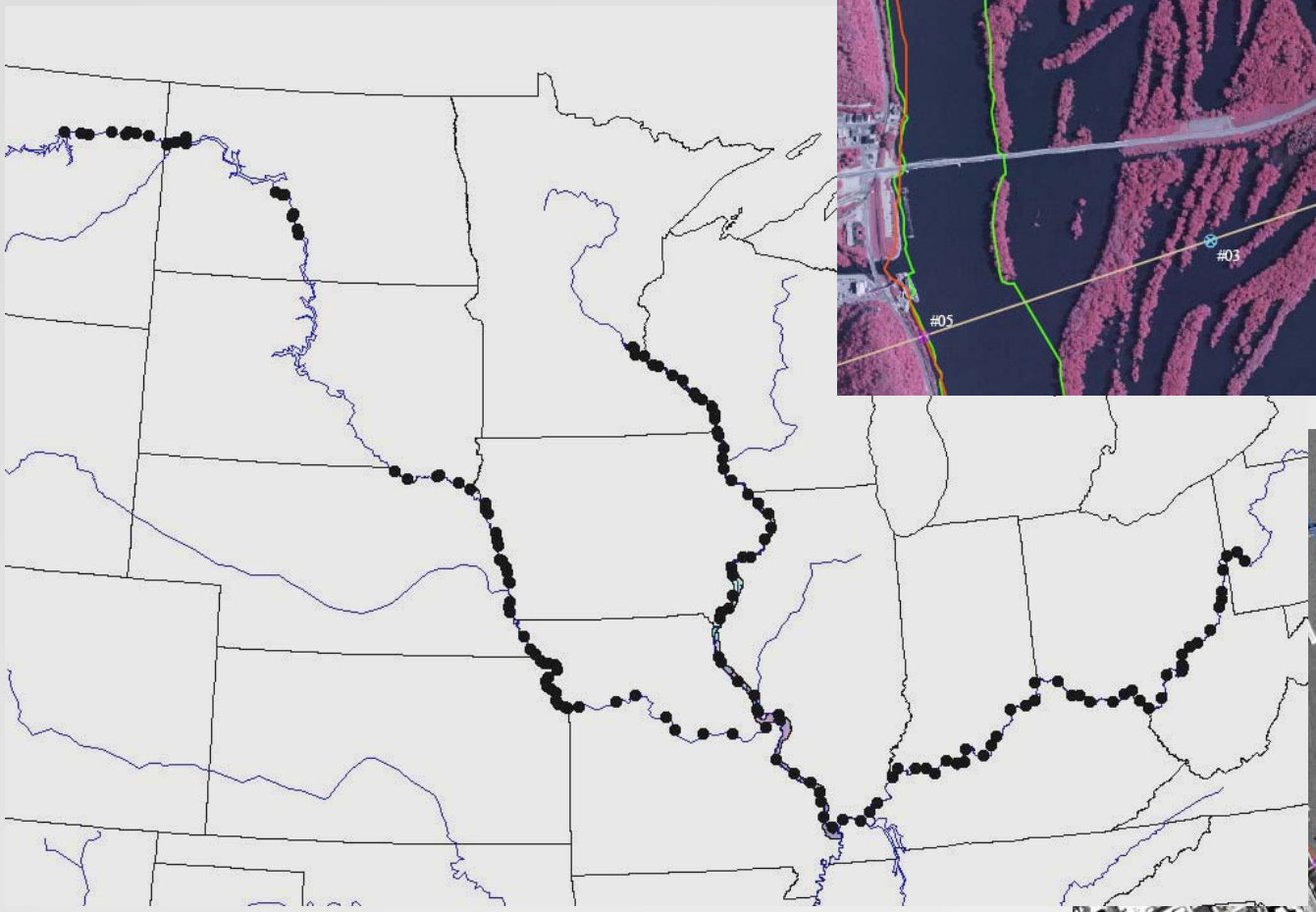
•**National Stream Survey—**a consistent, shore-to-shore assessment of wadeable streams of the US

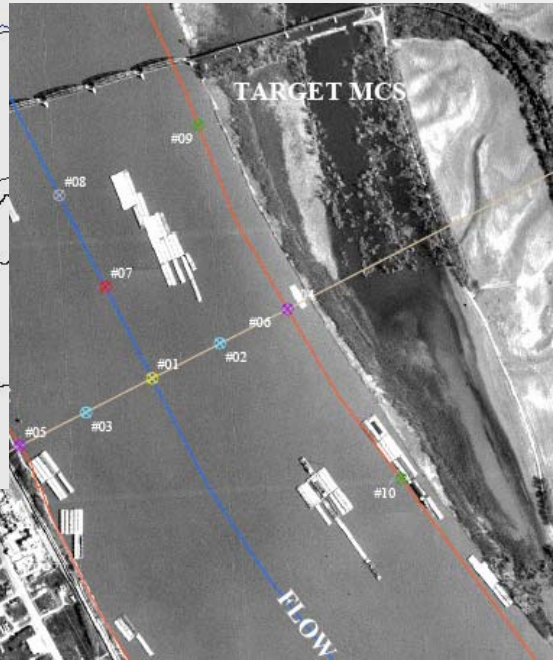
•**Wetlands & Great Lakes**

- **Designs**
- **Methods**
- **"Reference" conditions**

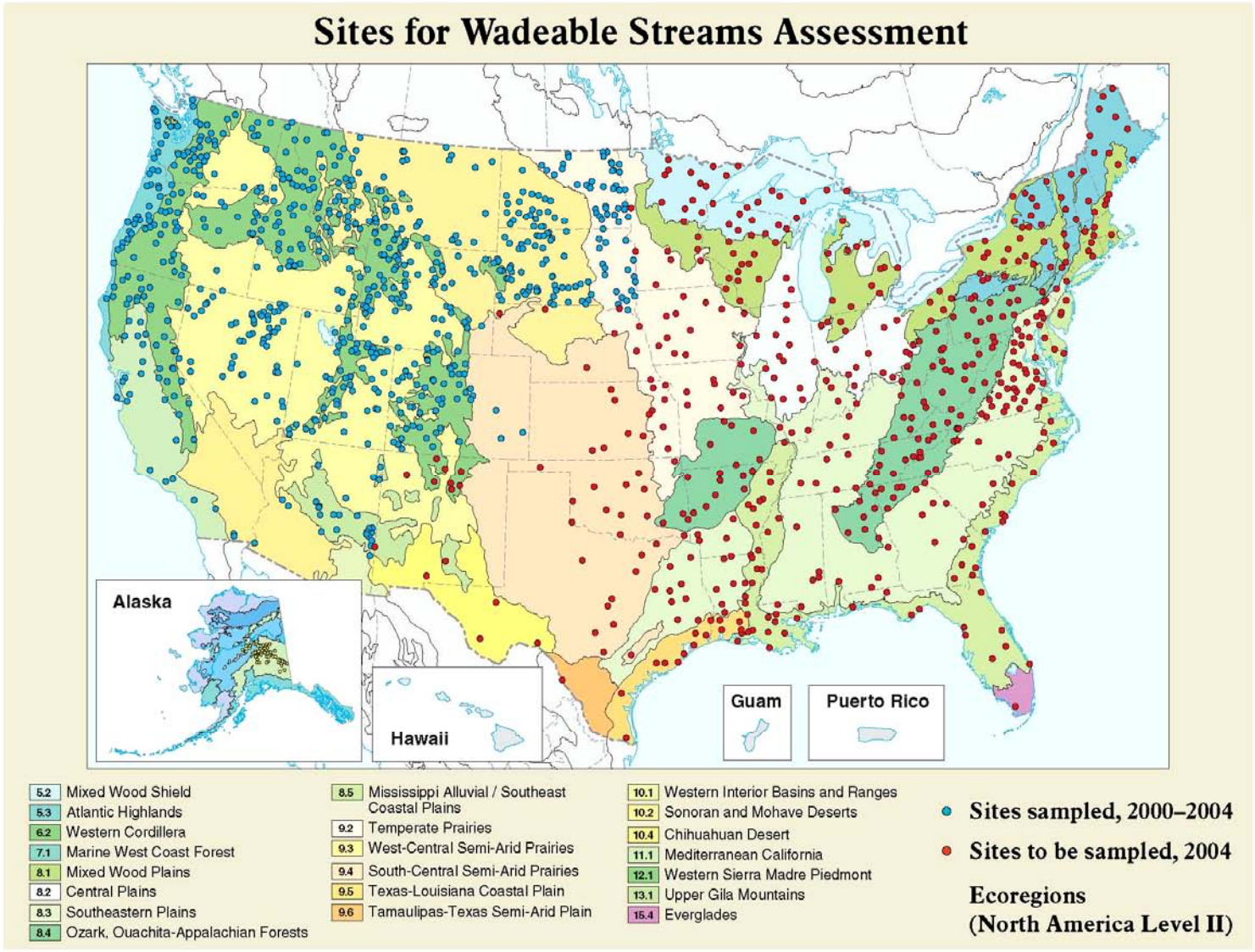
Great Rivers EMAP Sites

(2004-05)

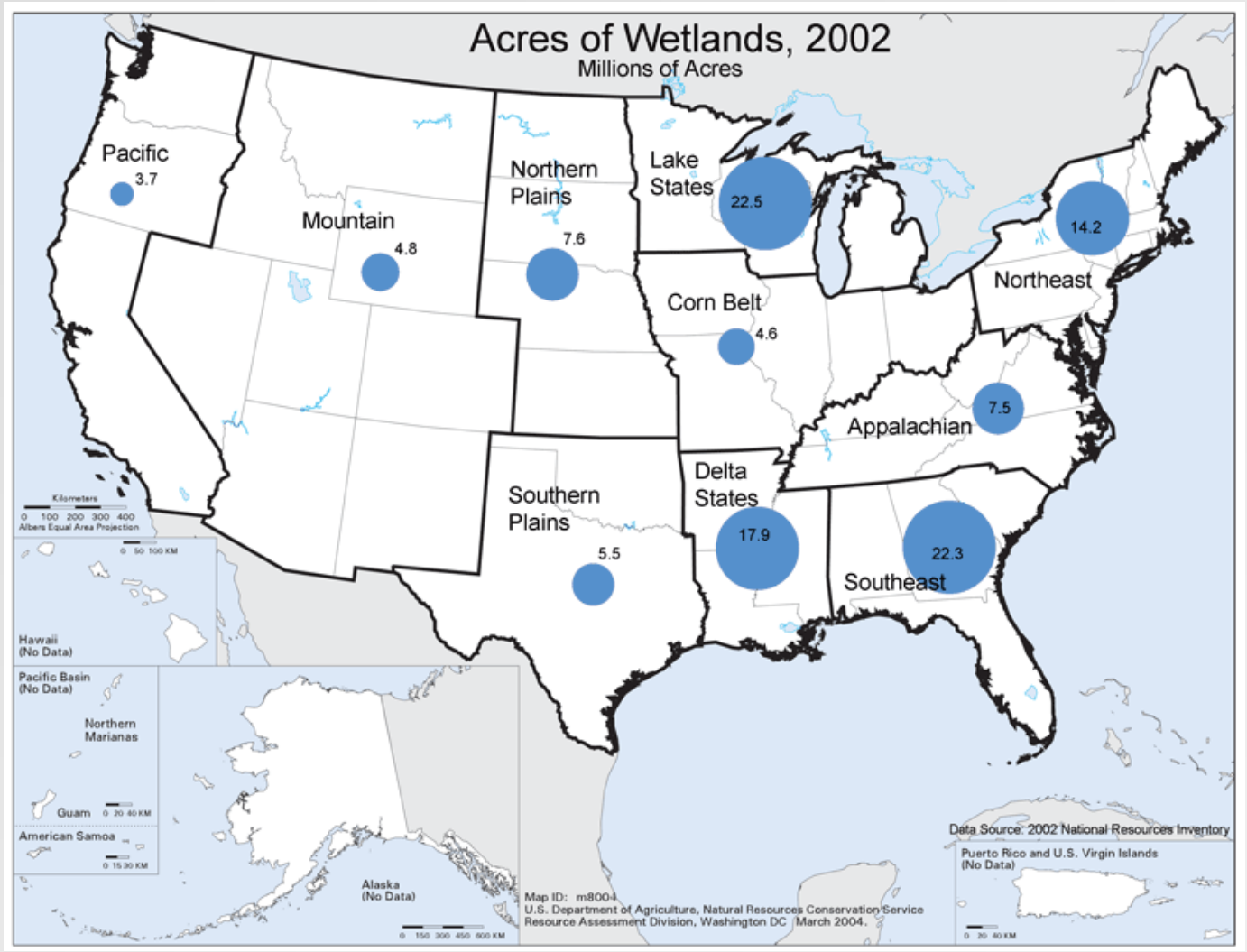




The National Stream Survey



EMAP Wetlands



EMAP Great Lakes